No need to wait for the clean air dividend

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Controlling smog and soot is the classic win-win situation, so it's great that the world is finally waking up to the idea

WHAT if there was a way to simultaneously slow down climate change, save millions of lives, improve crop yields and contribute to sustainable development and energy security? It sounds too good to be true, but it is possible. It won't be free or easy, but with some effort and moderate investment, it can be done.

The way to do it is to reduce emissions leading to two types of pollution: black carbon and ozone. These are the only pollutants that we know contribute to both global warming and poor air quality.

Black carbon is essentially soot, emitted from incomplete combustion of fossil fuels and biomass. It warms the climate in two ways: by absorbing heat in the atmosphere - similar to the greenhouse effect - and by reducing Earth's albedo, or ability to reflect sunlight. Inhaled into the lungs, it leads to cancer and cardiovascular disease.

Ozone in the atmosphere also acts as a greenhouse gas, while ground-level ozone is toxic to humans and plants, so leads to both premature death and reduced crop yields. Ozone is not emitted directly but is produced by the action of sunlight on other pollutants, which are known as ozone precursors.

Since black carbon and ozone are important components of soot and smog, a great deal of effort has already been put into developing methods to reduce emissions. So effective technology is available, but needs wider implementation.

The recommended control measures for black carbon include widespread and tight emission standards on diesel cars and trucks; improved solid fuel cooking stoves, brick kilns and coke ovens in the developing world; and a ban on the open burning of agricultural waste.

Implementation of these measures would have a rapid impact on the climate and human health, and also have the added benefit of greatly reducing emissions of carbon monoxide, an important ozone precursor.

A second key ozone precursor is methane, which is also a powerful greenhouse gas in its own right. Control measures include reducing leaks from natural gas pipelines and storage tanks, and capturing it from coal, gas and oil extraction, landfills and wastewater treatment plants. Aeration of rice paddies and manure management can also reduce methane releases.

Captured methane can often be sold or turned into power. In Monterrey, Mexico, for example, electricity generated from methane collected from the city landfill powers the public transportation system. So such measures can be beneficial even when ignoring the health and climate effects, as they can contribute to energy security and often pay for themselves.

According to calculations by me and my colleagues, phasing in all these measures over the next 20 years would reduce global warming by about 0.5 °C in 2050, half of the projected increase between now and then (*Science*, vol 335, p 183).

Regional benefits would be even greater, as black carbon disrupts rainfall patterns and magnifies warming and melting of snow and ice in parts of the world including the Arctic and the Himalayas.

On top of the climate benefits, cutting black carbon and ozone would prevent over 3 million premature deaths from air pollution, and increase yields of staple crops by roughly 50 million tonnes a year.

Improved cooking stoves would also decrease the demand for firewood in the developing world, reducing deforestation and freeing up time for those who collect wood - primarily women and children - to pursue other activities such as education.

Similarly, improved brick kilns now being used in parts of Latin America and Asia require half as much fuel as traditional ones and are less time-intensive for the operators. This means that in addition to their environmental benefits, these measures can contribute to sustainable and human development.

Tackling black carbon and methane is clearly a great idea, so why hasn't it been done already? There are many barriers. The upfront costs of some measures can be prohibitive even when they eventually pay for themselves. But this can be overcome by mechanisms such as international financing of capital costs.

For other measures, the costs are typically borne by a few while the benefits accrue to everybody. In such cases civil society and governments must get involved.

Governments are starting to act. In February, the US, Canada, Sweden, Bangladesh, Ghana and Mexico launched the Climate and Clean Air Coalition to support implementation of measures like these. This coalition will hopefully expand and achieve rapid, widespread adoption of measures to cut black carbon and ozone.

While the climate benefits will be substantial, it is important to note that these measures cannot substitute for cuts in carbon dioxide. Black carbon, ozone, carbon monoxide and methane stay in the atmosphere for a fairly short time - a few days for black carbon and about a decade for methane. They thus respond quickly to emissions changes and give us substantial leverage over near-term climate change.

In contrast, carbon dioxide is very long-lived and so responds slowly to emissions changes. This means that cuts have little immediate impact, but it also means they must be made now to avoid disastrous changes later on.

Controlling short-lived climate pollutants is thus an issue of fairness. Much as failure to reduce carbon dioxide emissions soon would condemn future generations to disastrous change, failure to reduce near-term climate change condemns those alive today to suffer worsening effects of the sort already seen.

Some wonder if we really can do both. We can, and we must.

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